

1.0 Introduction

1.1 Scope. This standard covers requirements for high performance thread rolling screws suitable for use in engineering applications. High performance thread rolling screws have performance capabilities beyond those normally expected of other standard types of tapping screws.

It is the intent that all types of high performance thread rolling screws shall meet the mechanical and performance requirements specified in this standard with the only difference between types being in their dimensional characteristics.

NOTE: The performance requirements covered in this standard apply only to the combination of laboratory conditions described in the testing procedures. If other conditions are met in an actual service application (such as different materials, thicknesses, hole sizes, etc.) drive torque and proof torque values may require adjustment.

1.2 Designation. There are several types of high performance thread rolling screws. The dimensions and illustrations for some of these are contained in Table 1.

2.0 Requirements. This standard provides for three grades of high performance thread rolling screws, Grade A, Grade B, and Grade C. The grades differ in materials and/or processing requirements.

2.1 Material and Process Requirements: Grade A

2.1.1 Material and Chemistry. The materials shall conform to the requirements of IFI-140. Selection of a given grade of material shall be based on conformance with the following chemical composition limits:

Grade A

Analysis ¹	Composition Limits (% by weight)			
	Carbon		Manganese	
	Min	Max	Min	Max
Ladle	0.15	0.25	0.70	1.65
Check	0.13	0.27	0.64	1.71

NOTE:

1. Ladle analyses are shown for informational purposes. Check analyses are mandatory and refer to individual determinations on uncarburized or core portions of screw.

2.1.2 Heat Treatment. Grade A screws shall be heat treated in a carbonitriding or gas carburizing system.

2.1.3 Quenching Media. Screws shall be quenched in a proper medium to obtain a 90 percent minimum martensitic microstructure.

2.1.4 Tempering Temperature. Minimum tempering temperature shall be 650°F.

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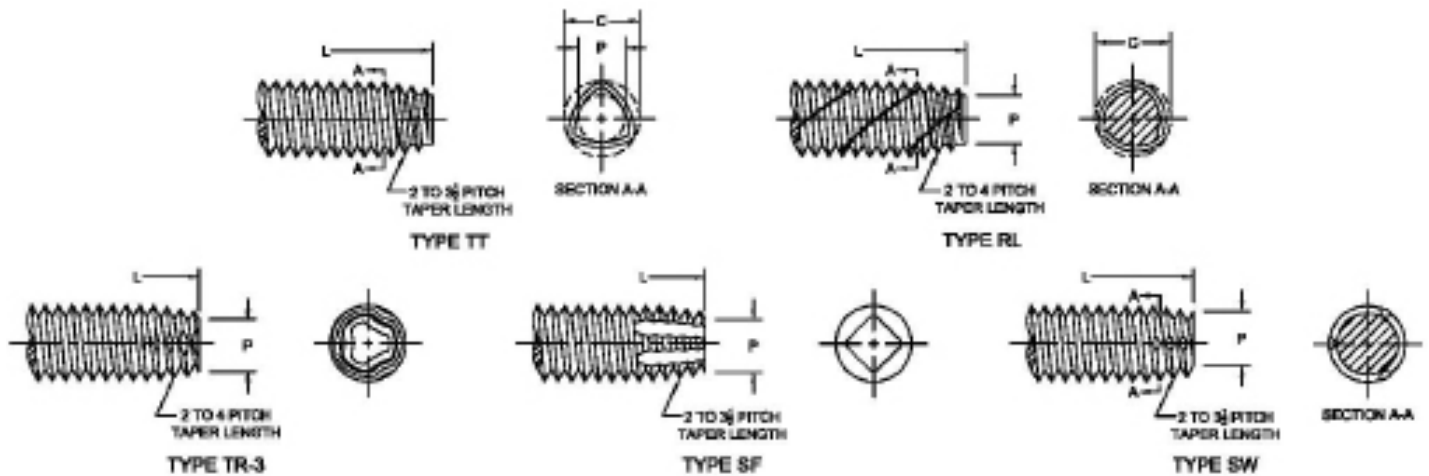


Table 1 High Performance Thread Rolling Screw Dimensional, Mechanical and Performance Requirements

Nominal Screw Size	Basic	Major or C Dia (in.)	Point Dia (in.)	Grade A Minimum Torsional Strength		Grades B & C Minimum Tensile Strength (lb.)		Test Plate Thickness		Test Plate Hole Size	Maximum Drive Torque	
		Max	Max	in. lb	ft. lb	Grade B	Grade C	Max	Min	+/- .001 in.	in. lb	ft. lb
2-56	0.0860	0.0875	0.0700	6		487		0.1270	0.1230	0.075	6	
3-48	0.0990	0.1010	0.0810	10		639		0.1270	0.1230	0.087	9.5	
4-40	0.1120	0.1145	0.0900	14		784		0.1270	0.1230	0.098	13	
5-40	0.1250	0.1275	0.1030	22		1,065		0.1270	0.1230	0.110	16	
6-32	0.1380	0.1410	0.1110	24		1,210		0.1270	0.1230	0.120	20	
8-32	0.1640	0.1670	0.1370	48		1,839		0.1905	0.1845	0.147	32	
10-24	0.1900	0.1940	0.1530	65		2,275		0.1905	0.1845	0.166	52	
10-32	0.1900	0.1930	0.1630	74		2,620		0.1905	0.1845	0.172	60	
12-24	0.2120	0.2200	0.1790	93		3,170		0.1905	0.1845	0.191	77	
1/4-20	0.2500	0.2550	0.2060	156	13	4,162	4,816	0.2540	0.2460	0.219	120	10
5/16-18	0.3125	0.3180	0.2640	330	27.5	6,873	7,952	0.3175	0.3075	0.277	240	20
3/8-16	0.3750	0.3810	0.3200	600	50	10,164	11,760	0.3800	0.3700	0.339	300	25
7/16-14	0.4375	0.4445	0.3750	840	70	13,939	16,128	0.4425	0.4325	0.394	480	40
1/2-20	0.5000	0.5075	0.4330	1,080	90	18,489	21,403	0.5050	0.4950	0.456	660	55
Notes:			1					2, 3				

NOTES:

1. The point diameter is acceptable if at least the first 360 degree thread enters a gage having a hole size equal to the specified maximum point diameter. The hole tolerance of the gage is +0 / -.001 in.
2. Test plates are cold rolled steel having a hardness of HRB 70-85.
3. These are test values and are not intended as application design parameters.

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2.2 Material and Process Requirements: Grades B and C

2.2.1 Applications. Grades B and C high performance thread rolling screws are designed to be able to carry a tensile load in an application as do through hardened bolts. The screw design incorporates a through hardened threaded shank and a selectively hardened area from the extreme end of the screw not to go beyond the third full thread. The selectively hardened area of the point must extend beyond the load carrying portion of the internal thread to perform correctly. In a through-hole application, the selectively hardened point must extend completely beyond the internally threaded assembly component. In a blind-hole application, a length of full-formed threads equal to at least one nominal screw diameter must be engaged in the hole in addition to the first three threads of the screw's point to assure correct performance.

2.2.2 Material and Chemistry. The materials shall conform to the requirements of IFI-140. Selection of a given alloy from IFI-140 shall be based on conformance with these chemical composition limits:

Grade B and Grade C

Constituent	Cast or Heat Analysis % by Mass	Product Analysis % by Mass
Carbon	0.35 – 0.40	0.33 – 0.42
Manganese	0.70 – 0.90	0.67 – 0.93
Silicon	0.15 – 0.30	0.13 – 0.32
Molybdenum	0.20 – 0.30	0.18 – 0.32

2.2.3 Heat Treatment. Screws of Grade B and C shall be heat treated in a continuous noncarburizing furnace using fine grain practice.

2.2.4 Quench Tempering Temperatures

2.2.4.1 Grade B shall be oil quenched and tempered at a minimum tempering temperature of 860°F.

2.2.4.2 Grade C shall be oil quenched and tempered at a minimum tempering temperature of 800°F.

2.2.4.3 Lead threads of Grade B and Grade C shall be induction hardened to a minimum hardness equivalent of Rockwell C45 for at least the first full formed thread and not to extend beyond the third full formed thread from the screw point.

2.3 Finish. Screws may be furnished plain or with a protective coating (electrodeposited or mechanical plating or chemical conversion coating) as specified by the user. At the option of the manufacturer screws may be provided with an additional supplementary lubricant as necessary to meet the performance requirements.

Electroplated screws shall be baked for a minimum of one hour within the temperature range 375°-450°F as soon as practicable after plating to avoid hydrogen embrittlement. Alternately, ASTM F1940 may be used for process control to prevent hydrogen embrittlement.

In cases where screws are plated or coated following delivery to the purchaser (or where plating or coating of screws is otherwise under the control of the purchaser) the screw producer shall not be responsible for failure of the screws to meet mechanical or performance requirements due to plating or coating. In such cases, additional screws from the same lot shall be stripped of plating or coating, baked, lubricated with machine oil and retested in the natural finish.

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